



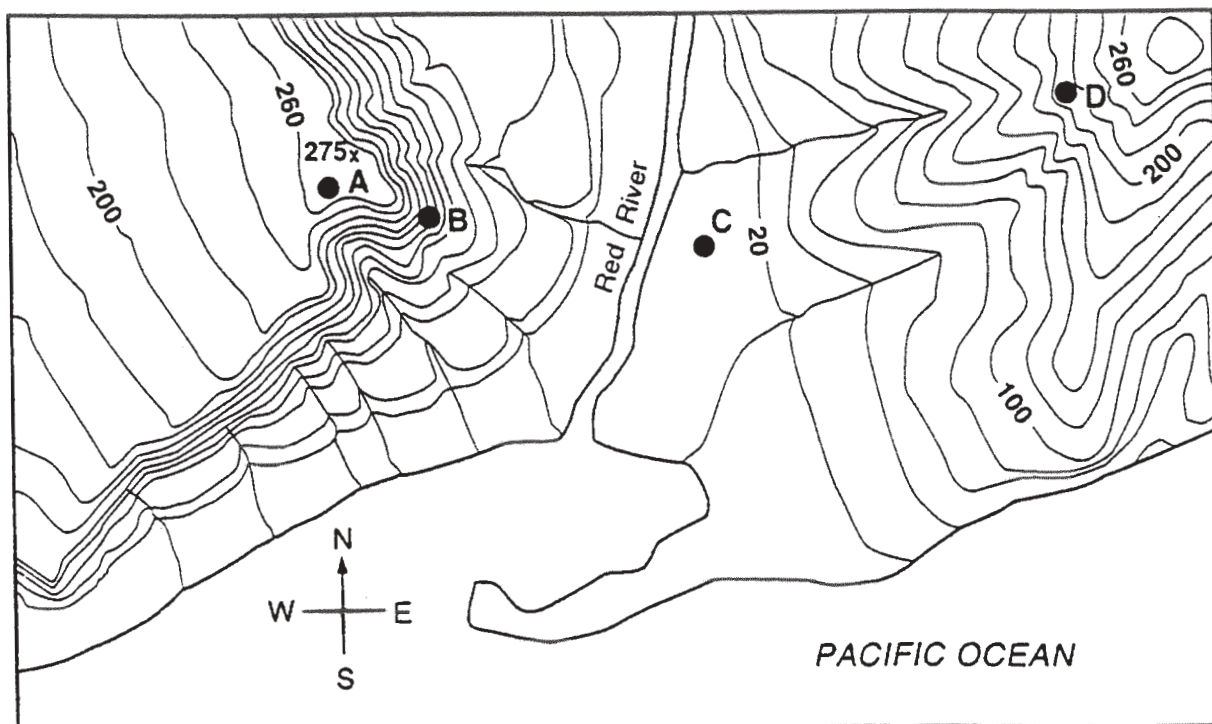
# High School Test in Science

*Released Items*

*Spring 2002*

- 1 Which of these has the **LEAST** influence on an area's climate?
- A latitude
  - B elevation
  - C soil conditions
  - D adjacent large bodies of water
- 2 Which of these instruments would be used to analyze the probable composition of the surface of a star?
- A a spectroscope
  - B an oscilloscope
  - C a radio telescope
  - D an optical telescope

3 At what point is the slope steepest?



A point A

B point B

C point C

D point D

Use the following information to answer items 7 through 10.

### Long Valley Caldera

The Long Valley caldera is a 200 square mile crater in California that sometimes receives hundreds of earthquakes per day. The crater was formed when a volcano erupted hundreds of thousands of years ago.

These days, scientists are worried that the volcano might erupt again. A large dome in the center of the crater has grown 80 cm since 1979. Underground heat is released into hot springs, as well as through natural volcanic vents called fumaroles. Also, scientists think that these earthquakes, often too weak to detect without a seismograph, are caused by magma slowly forcing its way to the surface.

- 7     How are the earthquakes in the Long Valley caldera different from earthquakes that occur on fault lines?
- A     They do not produce seismic waves.
  - B     They are caused by sea floor spreading.
  - C     They are too weak to detect without a seismograph.
  - D     They are not caused by the motion of tectonic plates.
- 8     Which of the following can explain why pressure from magma is generally strong in California and especially strong in the Long Valley caldera?
- A     California contains very few hot spots.
  - B     California contains many moraines and kettles.
  - C     California is located on a very long plate boundary.
  - D     California has higher temperatures than any other state.

Use the following information to answer items 7 through 10.

### Long Valley Caldera

The Long Valley caldera is a 200 square mile crater in California that sometimes receives hundreds of earthquakes per day. The crater was formed when a volcano erupted hundreds of thousands of years ago.

These days, scientists are worried that the volcano might erupt again. A large dome in the center of the crater has grown 80 cm since 1979. Underground heat is released into hot springs, as well as through natural volcanic vents called fumaroles. Also, scientists think that these earthquakes, often too weak to detect without a seismograph, are caused by magma slowly forcing its way to the surface.

- 9 Which of the following would be evidence **AGAINST** the claim that the Long Valley caldera will erupt soon?
- A live volcanoes located on fault lines
  - B non-volcanic areas located in craters
  - C non-volcanic areas having similar earthquakes
  - D live volcanoes having similar earthquakes before erupting

10 **(3 Points)**

When observing other volcanoes just before they erupt, identify two aspects of these volcanoes that scientists should study to determine if the Long Valley caldera is likely to erupt.

Explain one of your answers.

**ANSWER THIS ITEM IN YOUR ANSWER BOOKLET.  
NOTHING WRITTEN IN THIS TEST BOOKLET WILL BE SCORED.**

**MEAP HST 2002****Science****Item # 10****Scoring Rubric**

**Aspects that scientists  
should study:**

<b>Magma</b> Flow of magma Pressure of magma Magma rising up	<b>Dome</b> Presence of a dome Size of the dome Growth of the dome	<b>Fumaroles/Hot Springs</b> Behavior changes Acidity of water
<b>Earthquakes</b> Presence of earthquakes Magnitude of earthquakes Frequency of earthquakes Seismographic readings	<b>Temperature (must be specific)</b> Water temperature Ground/surface temp. Temp. of gases released <b>Note:</b> Air temperature is not acceptable	<b>Pressure (must be specific)</b> Magma pressure  <b>Note:</b> the presence of <u>fault lines</u> or <u>tectonic plates</u> is not relevant unless related to how they cause the production or release of magma.
<b>History</b> History of past eruptions		

**Explanations**

If volcanoes behaved in ways similar to the Long Valley caldera, then the Long Valley caldera might erupt as the other volcanoes did.

Note: the response must relate the explanation to the Long Valley Caldera.  
The response may either compare the Long Valley Caldera to other volcanoes **OR** compare other volcanoes to Long Valley Caldera **BUT** they must indicate that both are being compared

**Scoring Guide**

3 points = Two valid aspects are given and one is correctly explained.

2 points = Two valid aspects are given without a correct explanation.

OR

One valid aspect is given and correctly explained.

1 point = One valid aspect is given.

OR

Gives a correct explanation

0 points = Indicates no understanding of the item being tested.

- 14 The human embryo and the embryos of other animals with backbones have gill slits. According to modern evolutionary theory, this best supports the idea that
- A fish are our closest relatives.
  - B all embryos breathe through gills.
  - C all animals with backbones are related by common ancestry.
  - D all organisms have gill slits at an early stage in their development.
- 16 If scientists want to change the characteristics of a plant so that the new characteristics will be passed from generation to generation, they can do so by
- A altering the hormones that regulate the growth of plants.
  - B removing the flowers from the plant before pollination occurs.
  - C altering the genetic message contained in the DNA of the parent plant.
  - D adding scientifically designed fertilizers to the soil in which the parent plant is growing.

Use the following information to answer items 19 through 22.

**Edward Jenner**

Edward Jenner (1749-1823) was a British physician whose research led to the elimination of the disease smallpox. Smallpox is a contagious viral disease that infects the bloodstream of its victims. Smallpox was not always deadly, but it often left scars on its victims, who afterward were immune to the disease. Jenner noticed that farm workers who had been infected with a similar, but more mild, disease known as cowpox never caught smallpox. He administered a small dose of cowpox to a child, who proved immune to smallpox when he was exposed to smallpox two months later.

- 19 Which of the following is a way to determine if the body has a bacterial infection?
- A inoculate the patient with the disease
  - B test for increased levels of cholesterol
  - C look for antibodies in the bloodstream
  - D determine if hormones are in the blood
- 20 By administering the less harmful cowpox virus to people who were in danger of catching smallpox, Jenner administered which of the following?
- A bacteria
  - B antibodies
  - C a transplant
  - D an inoculation

Use the following information to answer items 19 through 22.

**Edward Jenner**

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- 21 Which of the following would be a control for Jenner's experiment?
- A a person who had been infected with either cowpox or small pox
  - B a person with cowpox who had already survived a smallpox epidemic
  - C a person who survived cowpox, but became infected with Lyme disease
  - D a person who had never had cowpox, but came in contact with smallpox

22 **(3 Points)**

In Edward Jenner's day, smallpox scars were often required for employment as a nurse. Give three reasons why this was so.

**ANSWER THIS ITEM IN YOUR ANSWER BOOKLET.  
NOTHING WRITTEN IN THIS TEST BOOKLET WILL BE SCORED.**

**MEAP HST 2002****Science****Item # 22****Scoring Rubric****Acceptable Responses**Element 1 : Exposure

People with scars have had smallpox.

People with scars have been exposed to smallpox.

Element 2 : Immunity

They are immune to smallpox.

They have built up resistance/white blood cells/antibodies against smallpox.

They will not catch smallpox from patients.

Element 3 : Passage to others

They will not give smallpox to patients.

They won't pass it along.

They are safe to work in hospitals.

Element 4 : Other Elements

They will have first hand knowledge of how to treat the disease.

They will know the symptoms of the disease.

They don't need to have fear or worry about catching the disease.

They will have empathy for patients with the disease.

They will understand what the patient is going through.

They will give hope through their survival of the disease.

**Scoring Guide**

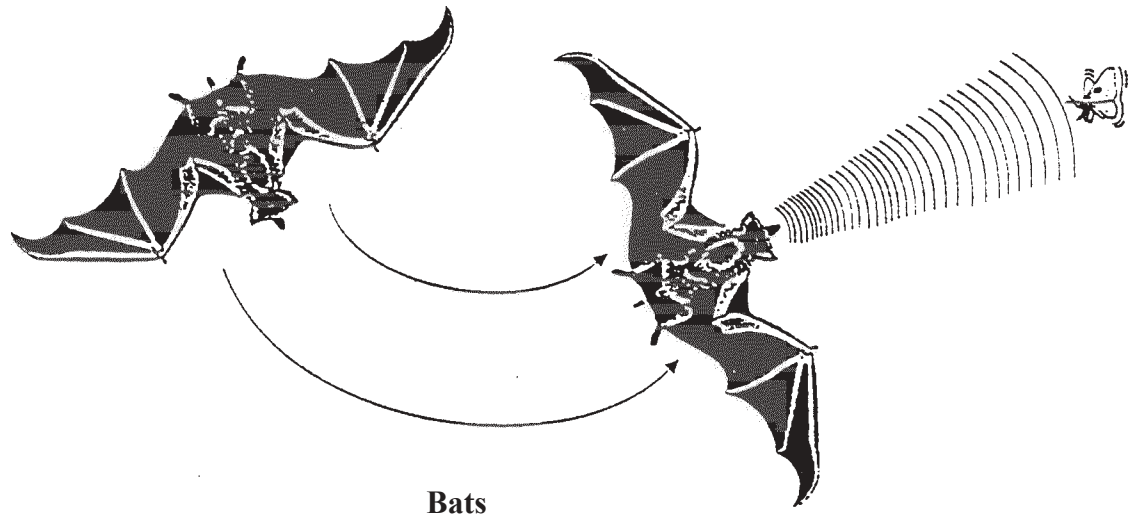
3 points = Three of the four elements are given correctly.

2 points = Two of the four elements are given correctly.

1 point = One of the four elements is given correctly.

0 points = Indicates no understanding of the item being tested.

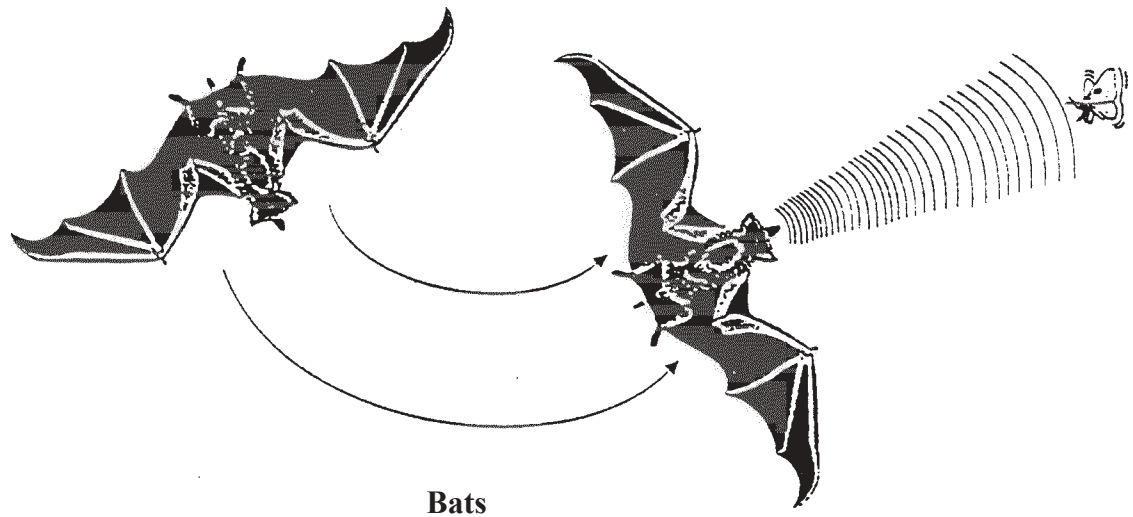
Use the following information to answer items 34 through 37.



Bats are not blind. On the other hand, some species of bat use sound waves to hunt and navigate while flying, especially at night. Bats (which are mammals) produce pulses of sound at extremely high frequencies through their mouths. These pulses are separated by short periods of silence during which the bats listen for these sounds to bounce off objects and return. Bats have highly developed ears, which pinpoint objects and prey by detecting these echoes, even if these echoes are .1% as strong as the original sounds.

- 34 In 1974, scientists performed investigations in which they covered parts of a bat's body and let it loose in a darkened, cluttered room. Which result would have helped demonstrate that bats use their ears to navigate?
- A Bats with covered eyes collided into objects.
  - B Bats with covered wings collided into objects.
  - C Bats with covered mouths collided into objects.
  - D Bats with nothing covered collided into objects.

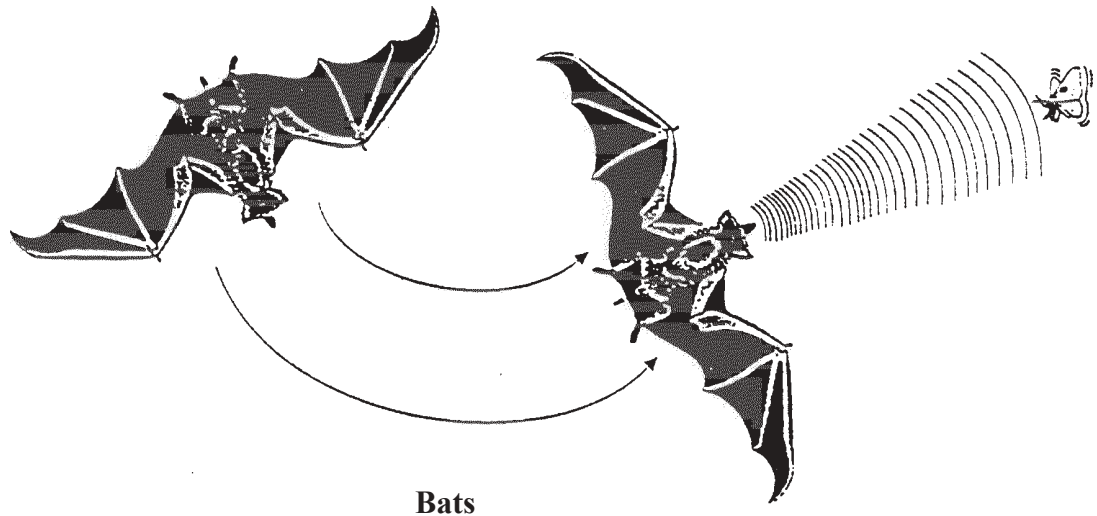
Use the following information to answer items 34 through 37.



Bats are not blind. On the other hand, some species of bat use sound waves to hunt and navigate while flying, especially at night. Bats (which are mammals) produce pulses of sound at extremely high frequencies through their mouths. These pulses are separated by short periods of silence during which the bats listen for these sounds to bounce off objects and return. Bats have highly developed ears, which pinpoint objects and prey by detecting these echoes, even if these echoes are .1% as strong as the original sounds.

- 35 Bats can detect echoes from moving objects which are a fraction of a centimeter thick. This is evidence that bats produce high frequency sounds and NOT low frequency sounds because low frequency sounds
- A move too slowly to reflect off objects that small.
  - B lack the gravitational potential energy to reflect off objects that small.
  - C do not carry enough electromagnetic energy to reflect off objects that small.
  - D have long wavelengths that are too broad to pinpoint motion in objects that small.

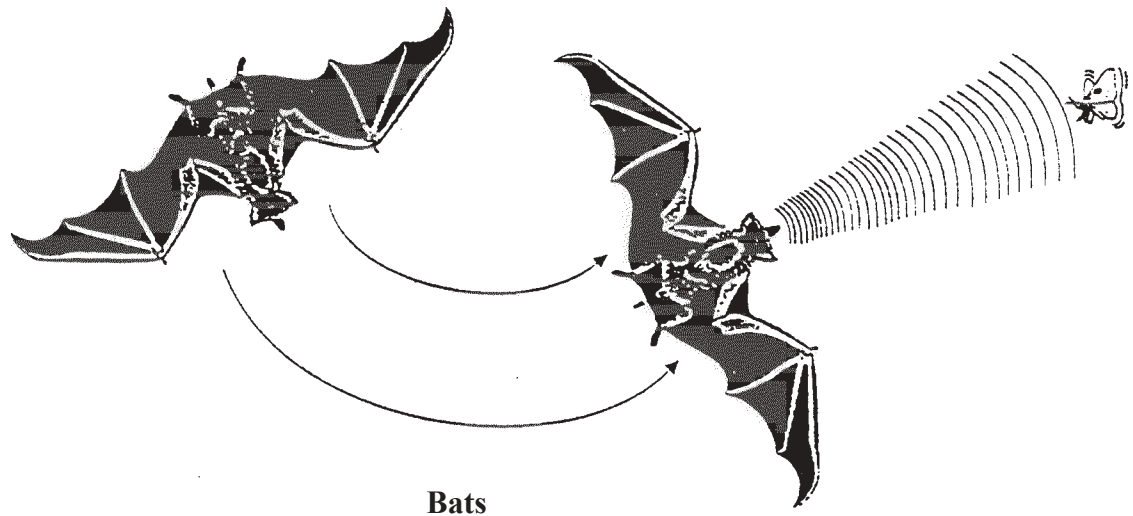
Use the following information to answer items 34 through 37.



Bats are not blind. On the other hand, some species of bat use sound waves to hunt and navigate while flying, especially at night. Bats (which are mammals) produce pulses of sound at extremely high frequencies through their mouths. These pulses are separated by short periods of silence during which the bats listen for these sounds to bounce off objects and return. Bats have highly developed ears, which pinpoint objects and prey by detecting these echoes, even if these echoes are .1% as strong as the original sounds.

- 36 A bat species can hunt perfectly well without its eyes, and yet it still can see. What does this tell us about sight as an evolutionary variation in this species of bat?
- A Sight is an unfavorable trait.
  - B Sight is a non-inheritable trait.
  - C Sight may be an unfavorable trait for hunting.
  - D Sight may be a favorable trait, but not for hunting.

Use the following information to answer items 34 through 37.



Bats are not blind. On the other hand, some species of bat use sound waves to hunt and navigate while flying, especially at night. Bats (which are mammals) produce pulses of sound at extremely high frequencies through their mouths. These pulses are separated by short periods of silence during which the bats listen for these sounds to bounce off objects and return. Bats have highly developed ears, which pinpoint objects and prey by detecting these echoes, even if these echoes are .1% as strong as the original sounds.

37 (3 Points)

Few animals can hear the high frequency sounds of bats. A certain species of moth, which bats prey upon, has evolved to hear these sounds.

- A How does the ability to hear the bats' sounds help the moth survive?
- B Explain how, though natural selection, this species of moth evolved to be able to hear the bats.

**ANSWER THIS ITEM IN YOUR ANSWER BOOKLET.  
NOTHING IN THIS TEST BOOKLET WILL BE SCORED.**

**MEAP HST 2002****Science****Item # 37****Scoring Rubric****Acceptable Responses**A: How helps to survive

- The moth can hear the bat coming
- The moth can have time to escape or elude the bat
- Other valid ways the ability helps

B: Explanation

## Step 1:

An *increased* ability in the population to survive made it more likely...

OR

The population's ability/trait to hear/elude bats made it more likely...

## Step 2:

...that moths with the hearing ability will reproduce.

...that moths with the hearing ability will pass on that trait.

...that moths with the hearing ability will make the trait more prevalent in the moth population.

**Scoring Guide**

3 points = Correctly indicates how the ability helps the moth survive and gives a complete explanation (contains both steps).

2 points = Correctly indicates how the ability helps the moth survive and gives a partial explanation (contains one step).

OR

Does not indicate how the ability helps but gives a complete explanation.

1 point = Correctly indicates how the ability helps the moth survive but doesn't give either step of the explanation.

OR

Does not correctly indicate how the ability helps but gives a partial explanation.

0 points = Indicates no understanding of the item being tested.

Use the following information to answer items 38 through 41.

**Lord Rayleigh**

In 1893, Lord Rayleigh wanted to determine the properties of nitrogen gas ( $N_2$ ). He obtained the nitrogen using two different methods:

- (1) He isolated nitrogen gas by heating solid ammonium nitrite ( $NH_4NO_2$ ) to produce water vapor ( $H_2O$ ) and nitrogen gas ( $N_2$ ).
- (2) He removed water vapor ( $H_2O$ ), carbon dioxide ( $CO_2$ ) and oxygen ( $O_2$ ) from air. The remainder was taken to be pure nitrogen.

The gasses were held under constant temperature and pressure. After the experiments, he filled identical flasks with the gasses. The flask from method 2 had slightly more mass than the flask from method 1.

- 38 Could Lord Rayleigh have simply weighed an individual nitrogen molecule to determine its weight?
- A No, it is impossible to weigh a gas.
  - B Yes, if it had been cooled to liquid form.
  - C Yes, if it had been held in place by a solid surface.
  - D No, it would not have been possible to weigh something that small.
- 39 If Lord Rayleigh wanted to test the conclusion that the extra mass in method 2 was due to the presence of another gas, he could have
- A performed experiment 2 again and removed only  $O_2$  from air.
  - B performed experiment 1 again and cooled the ammonium nitrite.
  - C performed experiment 2 again and removed the  $N_2$  from the flask.
  - D performed experiment 1 again and made  $O_2$  from a chemical reaction.

Use the following information to answer items 38 through 41.

### Lord Rayleigh

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The gasses were held under constant temperature and pressure. After the experiments, he filled identical flasks with the gasses. The flask from method 2 had slightly more mass than the flask from method 1.

40 Which of the following were the reactants used in methods 1 and 2?

- A nitrogen gas ( $\text{N}_2$ ) and air
- B water vapor ( $\text{H}_2\text{O}$ ) and air
- C ammonium nitrite ( $\text{NH}_4\text{NO}_2$ ) and air
- D nitrogen gas ( $\text{N}_2$ ) and carbon dioxide ( $\text{CO}_2$ )

### Lord Rayleigh

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The gasses were held under constant temperature and pressure. After the experiments, he filled identical flasks with the gasses. The flask from method 2 had slightly more mass than the flask from method 1.

41 (3 Points)

1	Atomic Number	PERIODIC TABLE																2
H	Element symbol																	He
3	4																	10
Li	Be																	Ne
11	12																	18
Na	Mg																	Ar
19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	Kr
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br		
37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I		
55	56	*	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86
Cs	Ba		Lu	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn
87	88	**	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118
Fr	Ra		Lr	Rf	Db	Sg	Bh	Hs	Mt	Uun	Uuu	Uub	Uut	Uuq	Uup	Uuh	Uus	Uuo
*Lanthanides		*	57	58	59	60	61	62	63	64	65	66	67	68	69	70		
			La	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb		
**Actinides		**	89	90	91	92	93	94	95	96	97	98	99	100	101	102		
			Ac	Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No		

Suppose the flask in method 2 also contained the element argon (Ar).

- A Would argon and nitrogen have similar properties?
- B Explain your answer.
- C Name one other element that you would expect to have properties similar to nitrogen.

**ANSWER THIS ITEM IN YOUR ANSWER BOOKLET.**

**NOTHING WRITTEN IN THIS TEST BOOKLET WILL BE SCORED.**

MEAP HST 2002  
Science  
Item # 41  
Scoring Rubric

Acceptable Responses

**Part A/B – Explanation of how argon and nitrogen are either the same or different**

Chemical Differences

- Argon and nitrogen have different atomic structures.
- Argon and nitrogen have different electron configurations.
- Argon and nitrogen have different valence.
- Argon and nitrogen are not on the same column/row on the periodic table.
- Argon and nitrogen have different reactivity/ionization energy.
- Argon and nitrogen are in different families.
- Other valid chemical differences.

**Note:** Differences in atomic number and atomic mass are not acceptable explanations.

Physical Similarities

- Argon and nitrogen are both gases.
- Argon and nitrogen are non-metals.
- Other valid physical similarities.

**Part C – Element similar to Nitrogen**

The element chosen must be linked to the chemical difference or physical similarity explained in Part A/B. The following lists identify the acceptable elements based on the explanations for Part A/B.

**If explanation gives a chemical difference**

P (phosphorus)  
As (arsenic)  
Sb (antimony)  
Bi (bismuth)

**If explanation is that they are not in the same column**

P (phosphorus)  
As (arsenic)  
Sb (antimony)  
Bi (bismuth)

*(Continued on next page)*

If explanation refers to differences in atomic number/atomic mass (even though this receives no credit in Part A/B)

C (carbon)	O (oxygen)	P (Phosphorus)
As (Arsenic)	Sb (Antimony)	Bi (Bismuth)

If explanation refers to the physical similarity that both are a gas

Se (selenium)	I (iodine)	Rn (radon)	Br (bromine)
O (oxygen)	Cl (chlorine)	Kr (krypton)	F (fluorine)
He (helium)	Xe (xenon)	Ne (neon)	

If explanation refers to the physical similarity that both are a non-metal

B (boron)	C (carbon)	O (oxygen)	F (fluorine)
P (phosphorus)	S (sulfur)	Cl (chlorine)	As (arsenic)
I (iodine)	He (helium)	Ne (neon)	Kr (krypton)
Xe (xenon)	Rn (radon)	Si (silicon)	Se (selenium)
Br (bromine)			

If explanation is that they are not in the same row

B (boron)  
C (carbon)  
O (oxygen)  
F (fluorine)  
Ne (neon)

### Scoring Guide

3 points = Complete explanation and correct identification of another element.

2 points = Complete explanation and incorrect identification of another element.

OR

Partial explanation and correct identification of another element.

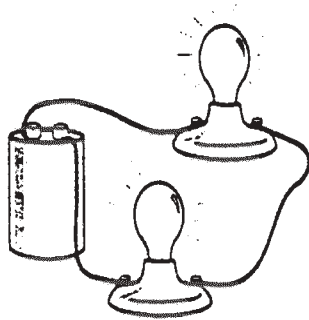
1 point = Partial explanation and incorrect identification of another element.

OR

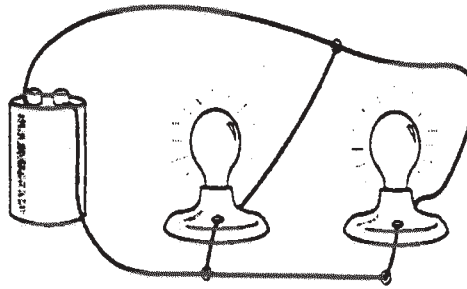
Correct identification of another element.

0 points = Indicates no understanding of the item being tested.

43



Circuit X



Circuit Y

In the diagrams above, all four light bulbs are lit. If one light bulb is unscrewed in each circuit, the other light bulb will

- A remain lit in both circuits.
  - B not be lit in either circuit.
  - C remain lit only in circuit X.
  - D remain lit only in circuit Y.
- 44 If you were building a house and wanted to position the heating and cooling air ducts for maximum efficiency, where would you position them?
- A Place the heating and cooling ducts in the ceiling.
  - B Place the heating and cooling ducts in the floor.
  - C Place the heating ducts in the floor and the cooling ducts in the ceiling.
  - D Place the heating ducts in the ceiling and the cooling ducts in the floor.

**Michigan Educational Assessment Program  
Statewide Test Item Analysis  
HST in Science  
All Students  
Spring 2002**

District: MICHIGAN DEPARTMENT OF TREASURY  
Codes: District- 99999 School- 0000  
Run Date: 08/06/2002

Multiple Choice							Constructed Response													Percent Receiving Condition Codes			
Item No.	Benchmark Code	Percent Answering by Response				Omit/Mult	Item No.	Benchmark Code	Percent Receiving Number of Points										A	B	C	D	
		A	B	C	D				0.0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0						
<b>Constructing New Scientific Knowledge</b>							<b>Constructing New Scientific Knowledge</b>																
21	1HS2	34	20	3	41*	0X	10	1HS1	7	6	17	14	36	8	8				1	0	0	4	
34	1HS2	15	8	67*	10	0X																	
39	1HS2	21	15	55*	9	1	<b>Reflecting on Scientific Knowledge</b>																
							22	1HS1	8	3	6	5	22	13	39				1	0	0	3	
<b>Reflecting on Scientific Knowledge</b>							<b>Using Scientific Knowledge in Life Science</b>																
09	1HS1	14	21	49*	16	0X	37	4HS2	5	4	60	7	7	3	10				0	0	0	3	
44	1HS1	6	13	70*	10	1	<b>Using Scientific Knowledge in Physical Science</b>																
							41	1HS2	30	3	8	2	12	4	30				2	0	0	8	
<b>Using Scientific Knowledge in Life Science</b>																							
14	4HS1	5	15	61*	19	0X																	
16	3HS3	13	7	69*	10	0X																	
19	2HS4	14	4	78*	4	0X																	
20	2HS5	21	39	4	36*	0X																	
36	4HS2	15	9	19	56*	1																	
<b>Using Scientific Knowledge in Physical Science</b>																							
35	4HS3	20	8	14	58*	0X																	
38	1HS3	20	36	13	30*	0X																	
40	2HS1	17	28	39*	15	0X																	
43	1HS4	9	12	10	67*	2																	
<b>Using Scientific Knowledge in Earth Science</b>																							
01	3HS1	14	4	79*	3	0X																	
02	4HS2	39*	17	9	35	0X																	
03	1HS1	24	61*	10	5	0X																	
07	1HS2	5	5	42	47*	0X																	
08	1HS2	8	14	69*	10	0X																	
<b>Number of Students Included: 105022</b>																							
							<p align="center">Condition Codes for the Constructed-Response Items:</p> <p>A Off-topic B Illegible C Written in language other than English D Blank/refused to respond</p>																
							<p align="center"><b>Using the Benchmark Codes</b></p> <p>You can link the individual items to their corresponding benchmark in the <i>Michigan Curriculum Framework</i>, approved in 2000.</p> <p>Each benchmark code contains four characters. The first character, an Arabic numeral, identifies the content standard under the specific strand. The next two characters represent the grade level column designation in the content standards documents (ES = Elementary School, MS = Middle School, and HS = High School). The number following these letters represents the specific benchmark in the column designated by the grade level.</p> <p><b>EXAMPLE</b> An item with benchmark code 1MS2 under Using Scientific Knowledge in Life Science is referring to context standard 1, Cells. Within that content standard, you need to look at middle school benchmark number 2, "explain why specialized cells are needed by plants and animals," to find the match.</p> <p><b>CAUTION</b> Making inferences about students based on their answers to individual items is inadvisable due to the low reliability of single item measures. These data should only be used to make inferences about the performance of groups that are classroom size or larger.</p>																

Omit/Mult = Omits and Multiple Responses  
X Number of students present rounds to zero